National Oceanic and Atmospheric Administration

Draft: An Introduction to NOAA's Surface Weather Program

Each year there are approximately 40,000 weather-related U.S. highway accidents resulting in nearly 7,000 deaths and $42 billion in lost productivity.

NOAA's Surface Weather Program applies the agency's weather and geospatial expertise to surface transportation safety, productivity, and mobility issues. Working with government and non-government partners in the weather and transportation fields, NOAA seeks to play a role in reducing the annual loss of life and productivity from surface transportation crashes and delays.

Figure 1: Aerial view of a weather related crash on I-95 outside Baltimore, MD on October 16, 2004. Photo: WBAL-TV

The Surface Transportation Weather Problem

Users of the surface transportation system need more timely, accurate and relevant weather and road condition information. In 2001 there were over 1.4 million weather-related crashes, leaving over 615,000 injured and over 6,900 dead[i]. Delay caused by adverse weather has reached nearly 1 billion hours per year[ii]. In contrast, the 10 year average for flood, lightning, tornado, hurricane, heat, cold, and winter storm fatalities combined is 251.

Recent U.S. Department of Transportation data shows over 22% of the total highway crashes were caused by adverse weather and most of these occurred when the pavement was wet during and after rainfall[iii]. Reduced visibility and frozen precipitation (e.g. snow, sleet) contributed to the remainder of the crashes. For drivers, maintenance managers, and traffic operations, the general weather forecasts for county-size areas presently produced by the National Weather Service (NWS) do not provide adequate geographic coverage[iv] and the needed update frequency for their decision-making scales and timeframes.

This gap is caused by three fundamental deficiencies. The first of these is the lack of transportation system relevant weather data (observations). Over the past decade, the number and sophistication of weather observations has grown exponentially, but rarely connected with roads, rails, or transit. Realizing that weather and road condition data could lead to better and more cost-effective decisions many states have invested in Road Weather Information Systems (RWIS) to support road maintenance, traffic management, and incident response. Unfortunately, there is no national system to bring these independent networks together for the benefit of the greater weather and transportation communities.

The second deficiency is awareness. In general, end users aren't aware of how to use current and planned weather services to improve their decisions. This is applies to most weather forecasters and transportation managers and operators and limits their mutual effectiveness.

The third deficiency is the current capability and skill of weather providers to deliver assessments and predictions. Surface level weather phenomena, dynamics, and interactions are not well understood.

What Can Be Done?

In order to reduce the effects of adverse weather, the nation's network of weather and road condition observations must be modernized and integrated, and this data must be disseminated to the public and to surface transportation system operators. The table on the next page gives a sample of how weather information can be used to aid transportation decisions.

Filling the gaps identified in the previous section is critical given the rapid growth in the use of transportation system is expected to continue to outpace the deployment of new infrastructure. For observations, a database containing the data from a dense national network of environmental sensors is needed for the production of relevant NOAA forecast grids. This database will also enable the private sector to produce route and customer-specific road weather observations and predictions.

Regarding assessment and prediction skill, more work is needed by all members of the weather enterprise (i.e. private sector, academic, and government) to advance modeling, data assimilation, and prediction techniques to produce sub-hourly information updates at the 2-5 km horizontal scale.

For awareness, the transportation and weather communities can make significant headway by deepening their relationship through additional interaction and cross-training.

Bringing all of these together will be a variety of intelligent transportation systems (ITS). Involvement in these efforts now will ensure the ITS infrastructure will be able to efficiently support weather applications and information.

Weather; Decision; and Time Scales	Actions[v]
Microscale; Warning; Seconds to Minutes	• Activate warning systems • Post travel conditions and restrictions on web site • Broadcast road conditions (e.g., highway advisory radio)
Mesoscale Operational Minutes to Hours	• Select mitigation strategies (e.g., advise, control, treat) • Control traffic flow (e.g., reduce speed limit) • Treat roads, bridges, ramps (e.g., apply chemicals, plow)
Synoptic Scale Operational Hours to Days	• Identify threatened roads and populations • Consider mitigation strategy alternatives • Manage resource deployment (e.g., call in maintenance crews)
Climatic Scale Planning Months to Years	• Design facilities and systems • Procure resources (e.g., hire/train staff, buy equipment) • Coordinate with adjacent states

NOAA's Contribution

NOAA will work in concert with our private sector, academic, and government partners in the transportation community and the US weather enterprise to reach a common goal of reducing the weather-related loss of life and property on the roads, rails, and transit. Our contribution will consist of efforts to increase the usage and utility of surface observations, maximize the value of existing NOAA products, and conduct research and development to identify appropriate actions to improve our services.

Priorities for NOAA in between now and Fiscal Year 2007 are to:

- Identify valid user needs that cannot be met with existing information
- Increase and improve products and services that support transportation systems
- Work with partners to conduct research and development in weather and geopositioning
- Improve the translation of research into operations
- Align activities with the Federal Highway Administration's CLARUS initiative to build a National Surface Transportation Weather Observation and Forecasting System

Key activities will include conducting workshops and communicating with internal and external partners; supporting the transition of R&D efforts such as NOAA's Integrated Surface Observing System and the Weather Research and Forecast Model; conducting science and socio-economic studies to identify and define future activities; and providing education, outreach, and training on how to use NOAA products in a transportation setting.

Benefits

We see a future where the number of annual weather related fatalities is so low, no one will believe that it was once 7,000 a year. We expect vehicles will share information among themselves and provide data to transportation and weather entities. Costs and environmental damage from over-application of winter maintenance chemicals will drop; traffic flow efficiency will increase through actions such as adjusting signal timing and drivers will have reliable information about how long their trip will take. In this future, weather information will be a ubiquitous part of our transportation experience.

While NOAA will be just one of the players, our role in the enterprise will provide a foundation for the overall effort. The Surface Weather Program will be an advocate for the transportation community within the agency and will contribute to an overall improvement in the level of service.

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[i] NHTSA Fatality Analysis Reporting System (FARS) and General Estimates System (GES)
[ii] Traffic Congestion and Reliability: Linking Solutions to Problems. Cambridge Systematics, Inc. and Texas Transportation Institute. July 2004
[iii] "Weather-Related Crashes on U.S. Highways in 2001" Lynette C. Goodwin, Mitretek Systems, Inc. December , 2003.
[iv] Weather Information For Roadway Transportation Preliminary Data Gap Analysis" Prepared by FHWA for OFCM/ICMSSR/Committee For Integrated Observing Systems May 2004
[v] Weather Information For Roadway Transportation Preliminary Data Gap Analysis" Prepared by FHWA for OFCM/ICMSSR/Committee For Integrated Observing Systems May 2004